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ABSTRACT

This bulletin contains materials suggested for use by agricultural teachers in the improvement of their agricultural mechanics programs. In its function as a guide to planning a teaching program in agricultural mechanics the document outlines the principles and procedures in course planning, 12 guiding concepts in the teaching of agricultural mechanics, safety education, shop management, evaluating the results of instruction, planning the course of instruction, and samples of time allotments. Sample breakdown units of instruction are provided, with lists of possible topics of discussion, teacher and student activities, and references. Topics of the units offered are: planning a home agricultural shop (an introduction to agricultural mechanics), agricultural carpentry, tool fitting, small engines, metal work, power tool construction, painting and finishing, agricultural plumbing, arc welding, oxy-acetylene welding and cutting, agricultural machinery, tractor maintenance, concrete and concrete masonry, agricultural electrification, electric motors, and agricultural surveying. (BP)

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A GUIDE FOR DEVELOPING THE INSTRUCTIONAL PROGRAM IN AGRICULTURAL MECHANICS

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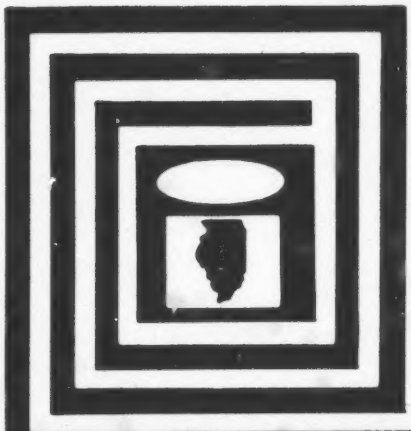

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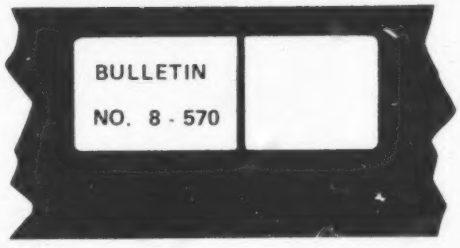

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A Guide
for
Developing the Instructional Program in
Agricultural Mechanics

Purpose

The materials contained in this bulletin are suggestive only; they are under no circumstances to be construed as a state wide course outline to be adapted per se by a given department. The bulletin, however, contains material that could be used to improve the instruction in agricultural mechanics in partically all departments. Many of the ideas included herein will need local adaptation to make best use of this material.

The committee worked diligently in accumulating materials that would be useful. All materials contained have a function to fit the needs of some departments. There is a wealth of "what" to teach and there is also unusual quantity of materials of "how" to teach agricultural mechanics. Many variations can be developed locally from these examples included. The format of the unit on agricultural machinery should logically lead into locally developed units on specific machines.

The check card on corn pickers is suggestive as a score card or as a check list. It is recommended that others be developed as needed to fit local instruction.

Grateful appreciation is given to the committee for its work in developing this material. The committee is composed of: Orval C. Floyd, L. J. Phipps, John Matthews, Ralph Benton, and Kenneth James.

G. Donavon Coil
Head Consultant

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GUIDE TO PLANNING A TEACHING PROGRAM IN AGRICULTURAL MECHANICS

Course plans and teaching plans are essential in all areas of instruction. They give the teacher a feeling of security and students soon learn whether the teacher is teaching by "ear" or whether he is following well thought out plans. Good course plans are especially important in the teaching of agricultural mechanics because many of the activities involved must be planned several months in advance of their execution, if they are to be successful. Much advance planning is necessary, for example, in the areas of agricultural machinery and tractors if the machines and tractors are to be available in the shop when needed. In agricultural mechanics many special types of equipment and supplies are necessary for the teaching of certain areas. If these special types of equipment are to be readily available, advance planning is essential. Also, in agricultural mechanics the teacher often needs to prepare himself for the teaching of certain problems. Unless he plans carefully and in advance, he will not have the time necessary to prepare himself adequately.

Principles and Procedures in Course Planning

The principles and procedures of course planning in the area of agricultural mechanics do not differ greatly from the principles and procedures used in planning other phases of instruction in agriculture. The first step is to assess the type of mechanical activities being performed on the farms and in the agricultural oriented businesses in the community. The second step is to determine the basic skills and abilities needed to perform the agricultural mechanics activities farmers and workers in agricultural oriented businesses should perform.

The third step is determining the areas of instruction in agricultural mechanics to emphasize to meet the needs of the local community. The fourth step is to determine the total amount of time to devote to agricultural mechanics instruction. Most teachers plan to devote a minimum of 25 percent of the total time available to agricultural education to agricultural mechanics instruction. The typical teacher devotes from 30 to 40 percent of the total time available to agricultural mechanics. Agricultural mechanics instruction is important. Some of this work is very time consuming. It is, therefore, easy to devote so much time to agricultural mechanics that not enough time remains to teach adequately the other phases of agriculture such as farm management, soils, crops, livestock, and FFA.

The fifth step in course planning in agricultural mechanics is deciding when the various units of instruction will be taught. For example, will agricultural machinery be taught in Agriculture III or Agriculture IV? For some, a prior question might be whether to teach agricultural mechanics as a separate course or to integrate this instruction into all courses of agriculture. Most teachers believe that it is better to integrate the instruction in agricultural mechanics into all courses.

The sixth step, after decisions have been reached regarding the various units of instruction are to be taught, is deciding how much time to devote to each unit or phase of instruction. The seventh step is deciding what season of the year to teach each unit.

After the teacher has taken these seven course planning steps, he should check his results by developing a calendar of instruction. A sample calendar of instruction is included in this publication. He should check his calendar of

instruction to determine whether his plans will keep the school agricultural mechanics shop in use throughout the year or whether it will be empty for part of the time. Next he should check the calendar to determine whether his course plans will result in the shop being crowded during certain portions of the year while it is almost empty during other times. Adequate course plans should insure the efficient and effective use of school's agricultural mechanics shop.

Guiding Concepts in Teaching Agricultural Mechanics

A list of 12 guiding concepts in the teaching of agricultural mechanics was developed for New York in 1958. 1/ Those concepts are intended to serve as guides in planning and developing a course of study and in teaching agricultural mechanics. The following items were adapted from this list:

1. Agricultural mechanics instruction is an integral part of the vocational agriculture program and thus contributes to education in agriculture for those enrolled in vocational agriculture classes. This instruction should develop proficiencies in the mechanical abilities needed in agriculture.

2. Agricultural mechanics instruction should develop students' abilities to make managerial decisions as well as to perform mechanical operations.

3. The course of study in vocational agriculture should provide preparation for the important mechanical jobs frequently used in agriculture. It should be organized by years considering the abilities and readiness of the students.

4. The students' supervised agriculture experience program should provide opportunities for the performance of agricultural mechanics jobs selected by the student, his parent, and the teacher of agriculture.

5. Agricultural mechanics instruction should place emphasis on educational outcomes rather than merely on items built or repaired.

6. Beginners need to learn certain skills before they can undertake major construction or repair projects, but these skills should only be taught when they can contribute to effective performance of important jobs.

7. Instruction in the operation, adjustment, servicing, and maintenance of farm power units and field machinery should take precedence over the repair of agricultural machinery or the construction of agricultural equipment.

8. For some agricultural mechanics activities instruction should be provided through demonstrations, and the use of teaching aids provided by the teacher, to prepare the student to perform such work as servicing and repairing water pumps, combines, balers, and large equipment. This would also apply to the construction of large items of agricultural equipment and repair, remodeling, or construction of agricultural buildings.

9. The program should include instruction in justifying, selecting, and using agricultural equipment, machines, and buildings, and the mechanics of soil and water management.

1/ Teaching Agricultural Mechanics in High School, C. W. Hill, Cornell Misc. Bul. 38, New York State College of Agriculture, 1960.

10. Individual on-farm or on-job instruction, as well as group instruction, should be given in teaching agricultural mechanics.

11. Field trips to observe, study, or participate in agricultural mechanics activities should be made when they can be conducted with efficient use of time.

12. Instruction should include planning and developing home shops.

Teaching Safety in Agricultural Mechanics

A major goal of agricultural mechanics instruction should be the development of attitudes and appreciations for safety. Students learn safety by practicing safe operations and by observing the examples set by the teacher. Safety may be taught as a separate unit of instructions, but it should also be integrated into the everyday work of the shop or the farm. The true test of the outcome of safety instruction is how the student operates when he is by himself.

Safety Equipment

It is the teachers' responsibility to provide basic items of safety equipment in the school shop, to keep this equipment in first-class condition, and to provide systematic instruction in its use. There are several categories of safety equipment that are important:

Fire extinguishers. It is recommended that no point in the shop be more than 40 feet from a fire extinguisher. Provide types that are suitable for each of the three classes of fires.

For Class A fires (wood, paper, and other such combustible materials) water is probably the best extinguisher. Always keep one or more pails of water in the welding area when welding. Water-type fire extinguishers are available that consist of a tank having a pump and short hose. Water should never be used, however, on Class B or C fires.

For Class B fires (gasoline, LP-gas or other petroleum products) use either a dry chemical or a CO_2 fire extinguisher.

For Class C fires (electrical) either the dry chemical or the CO_2 type extinguishers may be used safely and effectively.

Fire Blanket. A fire blanket should be provided for emergency use in the welding area. This is a reliable device for extinguishing clothing fires and is practical in the school shop. A fire blanket and holder may be purchased from commerical sources. The student may wrap himself in the blanket to extinguish a clothing fire. It may be any good quality wool blanket, such as those issued by the army and may be mounted in a home-made container.

First-aid Cabinet. Standard first-aid items such as antiseptic solutions, burn ointments, bandages, and tape should be kept in a first-aid cabinet in the shop. This material should be used for emergency first-aid and for treatment of minor injuries only. Students should be referred for proper medical aid when the slightest doubt exists concerning the seriousness of an injury.

Goggles or Safety Glasses. Goggles or safety glasses should be provided for use with grinders, portable saws, and other tools that may create a hazard to

the eyes. Many teachers require each student to wear safety glasses at all times when working in the agricultural mechanics shop. This safety practice is a requirement in most factories and is certainly to be recommended in school shops.

Respirators. Respirators should be provided for students to wear when operating a paint sprayer. Inexpensive paper respirators are available from paint suppliers for this purpose. These can be provided for individual use and have some advantages over the permanent types from a sanitation standpoint.

Safety color code

The use of a safety color system in the school shop does much to create an atmosphere for safety. The basic elements of a standard color code that has been widely accepted for use on power machines and other items of shop equipment are as follows:

Red - to designate locations of fire extinguishers and other fire-fighting equipment.

Green - to designate locations of safety equipment such as first-aid cabinets, fire blankets, safety goggles.

Orange - to designate parts of machines that may cut, crush, or otherwise injure.

Yellow - to designate operating and adjusting controls of machines; also to make tripping or bumping hazards when used with alternate stripes of black.

Blue - to designate electrical controls of machines; also to designate machines that are out of order, using a large blue tag, appropriately marked.

Ivory - to designate edges or margins, such as on vice jaws or saw tables.

Safe operating practices

The most important safety device is a careful operator. Certain safety rules for the use of tools and the operation of equipment should be taught, exemplified, and enforced in the school shop. Lists of safety rules such as those distributed by Vocational Agriculture Service should be prominently displayed on or near each power tool as a reminder to students who use the tools.

It is important to safety that hand and power tools be kept in good operating condition. This includes everything from keeping cutting tools sharp, hammer handles tight, and mushroomed heads ground off cold chisels, to proper guarding of saws, grinders and other power tools.

Require the use of safe solvents, such as Stoddard solvent, for cleaning parts and paint brushes, and provide facilities such as a parts washer for this purpose. Gasoline should never be used for cleaning purposes.

Provide a fireproof, metal container for the storage of rags. This would have a tight lid, preferably spring closing.

Provide for safe removal of fumes from welding and from the exhaust systems of engines and tractors. Fumes created by cutting or welding galvanized metal are particularly toxic. If tractors and engines are operated in the shop, a flexible hose connected to the exhaust pipe should be used to carry the exhaust gases into a fan-operated ventilating system.

Keep the shop free from combustible waste materials and the floor around power machines clear of materials that might cause students to stumble.

Management of the Agricultural Mechanics Shop

A large, well-equipped high school shop can greatly enrich the program in vocational agriculture. Unless it is properly organized and managed, however, it can become a liability rather than an asset. One important aspect of shop organization is tool arrangement.

Tool arrangement

There are many good systems of tool arrangement used by successful teachers. It requires considerable planning and effort to develop a workable system. The following are some goals and ideas to keep in mind:

1. Make tools easily accessible to students. The modern concept of a convenient working arrangement, whether it be in a dairy bar, kitchen, or factory, is to provide working areas with all equipment placed in such a way as to save steps and time. It may be desirable to designate an area of the shop for woodwork, metal work, tractor and machinery work, and so on. The principal tools and equipment used for a given type of work can be centered in cabinets or on panels in each area.

2. Mount tools in convenient position to take down and put back. Wherever possible, it is desirable to mount a hand tool so that it can be grasped by its handle and removed from the cabinet in position to use. Tools are put back in the same "natural" way. For example, it is easier to mount a hand saw by hanging it on a nail by the handle than to mount it with the blade up and the handle down. However, with the "easy" method, it becomes necesary to grasp the saw by the blade instead of the handle each time it is taken down or hung up.

3. Use a simple system for teaching students where tools belong. Most teachers find that a system of mounting tools on a flat surface with a painted silhouette behind each tool is the best device for teaching students where the tools belong. The old expression about a "place for everything" was "tailor made" for the agriculture mechanics shop. The principle of mounting each tool so the silhouette looks like the tool should be followed as rigidly as possible. For example, if a hammer is mounted flat against the panel the silhouette should look like a hammer. On the other hand, if it is mounted with the claws out, the silhouette indicates that some tool is missing but does not clearly show that it is a hammer or the type of hammer. Many tools require more cabinet room when mounted flat, but the hundreds of times each tool is taken down and put up in its normal life will amply reward this extra effort and expense.

4. Use some system of security to prevent tools from being "borrowed". The system to use depends on several factors in the local situation. In general, it should be no more complicated than necessary. In some

situations that only requirement is a lock on the shop door with all tools mounted on open panels. In other cases it is advisable to have all tools in cabinets that are locked. If this extreme is necessary, it is more convenient to have all locks operated by one master key.

5. Arrange tools in an attractive way that will add to the general appearance of the shop. An attractive system of tool arrangement gives the student and teacher a feeling of pride and an incentive to keep the rest of the shop clean and attractive. With a little forethought it is easy to arrange tools in a balanced, symmetrical pattern rather than to hang them up haphazardly. The background of the panel or cabinet should be painted in a color that harmonizes with the rest of the shop. Light green, tan, or gray are good colors for this purpose. The silhouette may be painted with a bright, eye-striking color such as orange which will stand out in sharp contrast when a tool is not in place.

6. Color code the tools to correspond with their cabinet or panel. This is part of the system of teaching students where the tools belong and greatly facilitates the clean-up period. A small band or spot of color can be painted on each tool, using a different color for each cabinet or panel. The same color mark can be placed on that cabinet or panel so the student knows which location is right for each tool.

7. Consider safety in the system of tool arrangement. Sharp tools, such as wood chisels, should be mounted with the cutting edges down and near the lower part of the cabinet or panel. If mounted above other tools, hand injuries may result when these other tools are removed. Heavy tools should be mounted securely so they will not jar loose and fall down on someone working under them.

Shop housekeeping

An important aspect of shop management involves keeping the facilities clean and orderly. A neat, attractive shop is a source of pride to the teacher, students, administrators, and the community. A disorganized, untidy, poorly-managed shop is a source of embarrassment and a poor advertisement for the entire program in agricultural occupations.

A successful system of shop housekeeping must divide the responsibility between the teacher, the students, and the school's janitorial force. Most situations that can be criticized for poor housekeeping develop because of the failure of one or more of these three to cooperate fully. Teachers can take positive steps to promote good housekeeping in the agricultural mechanics shop.

Provide adequate storage

A great deal of disorder can be prevented if sufficient closed storage is provided for normal amounts of lumber, metal, nails, bolts, paint, and other supplies. Temporary supplies of building materials for projects that are under way may have to be stored in the open, but it is very difficult to maintain an orderly shop if all supplies are constantly in view. Cabinets, racks, and storerooms or overhead storage areas are necessary to control this problem.

Require students to wear acceptable shop clothing

Requiring students to dress for shop in keeping with the type of work being done does much for morale and meets with favor with adminstrators and parents.

Many teachers insist on a standard garment such as a coverall, often with students' names, school name, or the FFA emblem on the back. In other cases, clean work clothes are acceptable. In any case, lockers or other storage for these garments, where they can be hung neatly, should be provided.

Develop an efficient clean-up system

A daily clean-up system in which all students participate is necessary to keep the shop in first-class condition. Policies vary from school to school as to what responsibility should be taken by the janitorial force in cleaning the shop. However, it is generally considered that part of the educational process is teaching students to keep a shop neat and clean. It is hoped that habits of cleanliness will carry over to the students' home shops.

One of the first steps in developing a plan is to identify clearly the various clean-up duties. Students are generally assigned on a rotating basis to be responsible for these duties. A common system is to appoint one student to be shop foreman, one or more to be tool checkers, bench brushers, floor sweepers, etc. Students who are unassigned for that day or period are expected to pick up and put away tools and materials, move items for the floor sweepers, and otherwise help in the clean-up period.

It is the duty of the shop foreman to start the clean-up operation on signal from the teacher. He supervises the class during clean up and dismisses them to wash up and change clothes when the job is completed.

The tool checker is not generally expected to put away the tools himself, but to check each cabinet or rack, and call out for tools that are missing. When all tools are in place, he locks the cabinets and reports to the shop foreman.

The bench brushers work ahead of the floor sweepers, removing all debris from such areas as the benches and power tool tables. They may assist the floor sweepers by holding the dustpans and helping pick up the dirt after it has been swept into piles.

The teacher supervises the entire operation and helps the foreman maintain certain rules such as permitting no one to wash up until the tool checker has reported all tools have been put away and that the shop cleaning has been completed.

A rotating system of assigning the various shop duties can be maintained with a shop duty wheel (Figure 1) or a shop duty board with hooks and tags (Figure 2). Assignments are usually changed each week, or oftener, depending on the length of time a particular class is to be in the shop and on the size of the class.

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MECHANIZATION OF ASSIGNMENTS FACILITATES CLEAN UP

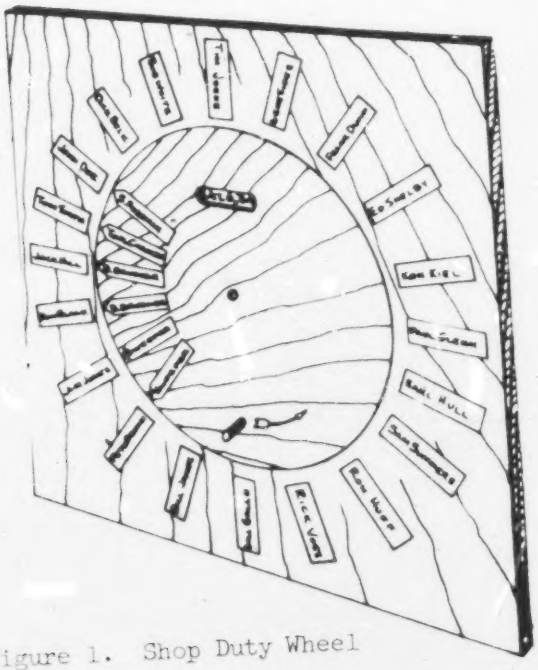

Figure 1. Shop Duty Wheel

This arrangement is made of two parts; (a) a square shell and (b) a circular movable wheel.

Part (a) carries the name of the boys spaced evenly around the outside of the wheel.

The duty assignments are placed inside the wheel and spaced apart in same spacing as the names. The wheel moves one space each day, thereby acquainting a new boy with a different assignment each day.

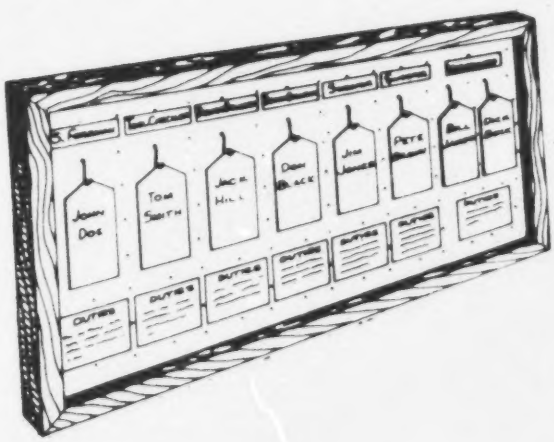

Figure 2. Shop Duty Board

The duty board requires more time in changing, but works well if the duty assignments run for as much as one week.

If necessary, more than one class can use the board simultaneously by color coding cards or names.

Shipping tags may be used as name cards

Shop discipline

Most problems of student discipline are avoided by a good system of shop organization and management, and by having a well-planned and organized instructional program. Good conduct reflects proper student attitudes toward the teacher, toward each other, and regarding the importance of the activities in which they are engaged.

Shop atmosphere is more informal than that found in most classroom situations; consequently, students require freedom to move about and engage in various kinds of physical activity. However, standards of acceptable behavior must be clearly understood. A minimum number of clearly defined rules is more desirable and more effective than many rules indefinitely expressed and indifferently followed.

Certain regulations are important in the interest of safety, particularly regarding conduct around power machines. Students should understand the need for such rules and accept them as absolute if they are to continue to work in the shop.

The importance of thorough planning of instruction cannot be emphaisized too highly in its effect on shop morale and discipline. Planning that involves the students as well as the teacher goes a long way to producing a seriousness of purpose that is the basic element in good shop discipline.

EVALUATING INSTRUCTION IN AGRICULTURAL MECHANICS

One of the difficult aspects of teaching agricultural mechanics, but a very important part is that of evaluating the results of instruction and assigning student grades. Following are some of the factors that may be taken into consideration:

1. Quality of the finished product. This is important whether it is an item of equipment that has been constructed or repaired, a wiring exercise completed, or a twist drill sharpened. This is the easiest part of evaluation and should not be the only measure of a student's grade.

2. Progress toward a goal. This is probably the most important measure of student success and is the most difficult to measure. This involves the setting of goals by each student in terms of what he wishes to learn and accomplish and what specific abilities he intends to develop or improve. It requires determining at what point the student is at the beginning of a unit of instruction so that his improvement can be measured at the end. It may happen that the student who turns out the best quality of work has not progressed as far as one who achieves less but who started at a lower level of ability.

3. Attitude. Credit should be given for a cooperative attitude and willingness to abide by the rules of good conduct and respect for the rights of others.

4. Effort. Consistency of effort and industry should be rewarded. A student who tries and "tends to business" should be given credit as an important part of shop work.

Many teachers make a practice of meeting the class for a few minutes in the classroom each day before going to the shop. Each student is asked to write down

what he proposes to do for the day, what abilities he intends to develop, and how much he hopes to accomplish. At the end of the period, he notes how nearly he succeeded in meeting these goals. The teacher may add his comments and collect these slips for his daily record. Following is a sample form that may be used.

STUDENT DAILY RECORD - AGRICULTURAL MECHANICS

Date_____ Student's name_____

Goals for today

Activities:

Abilities to be developed:

Amount to be accomplished:

Results

Abilities developed:

Work accomplished:

Teacher Notes

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Periodic examinations are generally given to be used in determining student grades during and at the end of units of shop instuction. Questions should be included that will measure essential knowledge including thought questions to measure abilities to perform certain knowledge and skills that have been taught. The practical examination may also measure judgment and the ability to solve problems in applying knowledge and skills that have been learned.

Planning the Course of Instruction

The first step in planning the course of instruction in agricultural mechanics is to decide what units shall be included, in which year each shall be taught, and about how much time shall be devoted to each unit.

A. Conventional Program (Integrating agricultural mechanics into four years of agricultural occupations.)

A convenient way to set this down is in the form of a time allotment. Following is a sample time allotment for integrating 14 units of instruction into a four-year program of vocational agriculture. This sample will average approximately 34% of the total school time assigned to agricultural mechanics. Local option can vary the percentage from 28% to 40%.

The instruction for young and older adults will need to be integrated into the time schedule at times when the shop load is not at a peak. Some teachers conduct some adult classes in mechanics during school vacation periods to prevent overcrowding the facilities.

B. Special Unit Courses

As the concept of the role of agricultural occupations is broadened to include education for off-farm occupations, requiring knowledge of skill in agriculture, the organization of the agricultural mechanics phase of instruction may change. Many of these occupations require special competencies in agricultural mechanics. This is particularly true in the areas of tractors and farm machinery, welding and metal work, electricity and conveniences, and construction.

One plan of organization that may meet the needs of students preparing for off-farm agricultural occupations requiring mechanical competencies is to provide special unit courses of a full semester in length during the junior and/or senior years. These would normally follow a basic two or three year course in agriculture in which the beginning phases of agricultural mechanics are integrated with instruction in production agriculture.

Unit courses would permit instruction in some "depth" in two or more areas such as the following:

1. Farm Power and Machinery
2. Welding and Metal Work
3. Electricity and Conveniences
4. Construction Materials and Methods

SAMPLE TIME ALLOTMENT

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Agricultural Mechanics

Units	Courses	High School Pupils Range in days per year I	II	III	IV	Older Adults	Young Adults
						Based on needs as determined by consulting committee	
1.	Planning the Home Shop	5-7					
2.	Hand Woodworking in Agriculture	15-20				"	"
3.	Fitting Agriculture Tools	5-10				"	"
4.	Small Agricultural Engines		15-20			"	"
5.	Metal Work for Agriculture	5-10	10-15			"	"
6.	Agriculture Structures with Power Tools		20-25			"	"
7.	Paints and Painting		2-5			"	"
8.	Rural Water Supply and Plumbing	7-12				"	"
9.	Welding, Construction, and Repair of Agricultural Equipment			30-40		"	"
10.	Farm Machinery, Maintenance and Equipment			15-20	10-15	"	"
11.	Tractors & Farm Power			15-20	10-15	"	"
12.	Concrete and Masonry for Agriculture				10-15	"	"
13.	Electricity for Agriculture				20-25	"	"
14.	Farm Surveying						
Totals		37-59	47-65	60-80	60-85		

Having established a proposed time allotment, the next step is to work out a calendar showing what class will be in the shop and what unit of instruction will be taught each week throughout the school year. In planning the calendar, consideration should be given to keeping the shop busy at all times, avoiding overcrowding by having two groups working on units that require large amounts of space at the same time. Some units of instruction fit better at certain seasons of the year. For example, surveying requires outdoor work in good weather. Tractor and machinery work may have to be done in winter when equipment can be spared from the farm. Following is a sample calendar:

A SAMPLE CALENDAR
FOR
AGRICULTURAL MECHANICS

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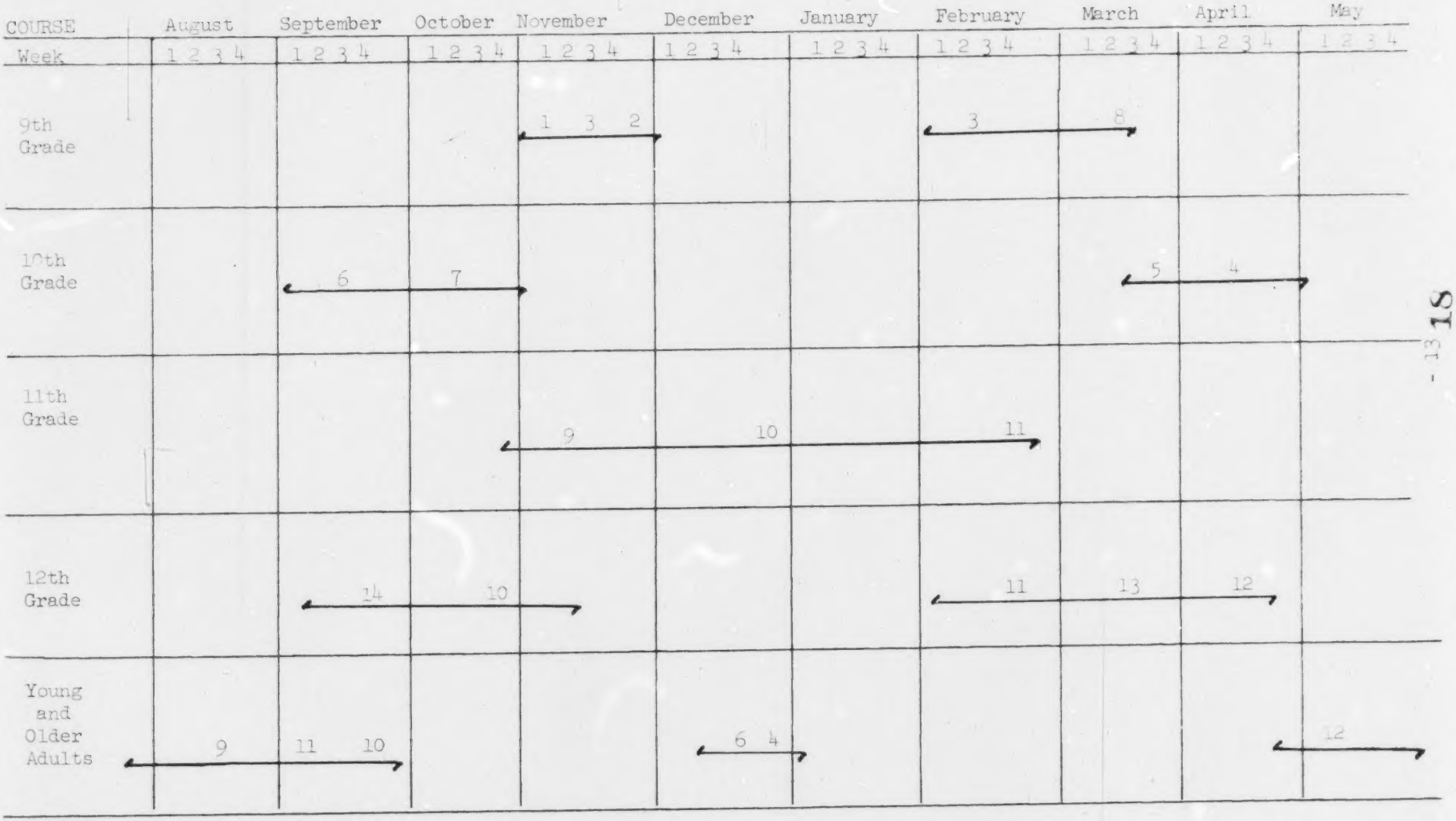
Units* - Course - Time



*See previous page for unit names

Sample Calendar - Agricultural Mechanics

Agriculture

I	II	III	IV	
				September
	Power Tools Constr.			1st Week
	Power Tools Constr.			2nd Week
	Power Tools Constr.			3rd Week
	Power Tools Constr.		Land Surveying	4th Week
				October
	Power Tool Constr.	Welding Etc.	Surveying	1st Week
	Power Tool Constr.	Welding Etc.	Surveying	2nd Week
	Painting	Welding Etc.	Farm Machinery	3rd Week
	Painting	Welding Etc.	Farm Machinery	4th Week
				November
Home Shop		Welding Etc.		1st Week
Woodworking		Welding Etc.		2nd Week
Woodworking		Welding Etc.		3rd Week
Woodworking		Welding Etc.		4th Week
				December
Woodworking		Farm Machinery		1st Week
		Farm Machinery		2nd Week
		Farm Machinery		3rd Week
				January
		Farm Machinery		2nd Week
		Farm Machinery		3rd Week
		Farm Machinery		4th Week
				February
Fitting Agr. Tools		Tractors		1st Week
Fitting Agr. Tools		Tractors		2nd Week
Fitting Agr. Tools		Tractors	Tractors	3rd Week
Metal Work		Tractors	Tractors	4th Week
				March
Metal Work			Electricity	1st Week
Plumbing	Metal Work		Electricity	2nd Week
Plumbing	Metal Work		Electricity	3rd Week
	Metal Work		Electricity	4th Week
				April
	Small Agr. Engines		Electricity	1st Week
	Small Agr. Engines		Electricity	2nd Week
	Small Agr. Engines			3rd Week
	Small Agr. Engines			4th Week
				May
			Concrete	1st Week
			Concrete	2nd Week

Agricultural mechanics instruction should involve the out-of-school persons in the community. Frequently this instruction can be offered at a time when the educational supplies are being used with the high school classes. For example, an adult class in automation could be conducted at the time that the electrical control kit is being used with the high school classes.

The final step in planning the program of intruction in agricultrual mechanics is to prepare a breakdown in some detail of each unit. This may include a listing of some topics for class discussion, a list of proposed teacher activities, and a list of student activities. It may also include a list of student references for study in preparation for discussion and for shop practice.

Following are sample breakdowns for each of the units which have been listed previously.

SAMPLE BREAKDOWN OF UNITS OF INSTRUCTION

Planning the Home Agricultural Shop--An introduction to Agricultural Mechanics

Possible topics for discussion

1. What is meant by "agricultural mechanics"?
2. How is agricultural mechanics related to other parts of the agricultural occupations program?
3. How is agricultural mechanics related to the business of farming and agricultural oriented businesses?
4. Can you justify a well-equipped shop?
5. What different types of shop buildings may be considered?
6. What are the general requirements for an agricultural shop, considering:
   a. Location with respect to other buildings
   b. Amount of space--dimensions
   c. Number and size of doors
   d. Heat
   e. Light--natural and artificial
   f. Electric power requirements
   h. Power tool needs
   i. Organization and arrangements, including benches, cabinets, parts and materials storage
   j. Safety requirements--fire protection, ventilation, electrical safety, etc.

Possible teacher activities

1. Prepare and duplicate lists of tools in the school shop for each student.
2. Demonstrate use of hand tools.
3. Demonstrate system of color-coding tools and matching them with silhouettes.

Possible student activities

1. Field trip to visit good agricultural shops in the community.
2. Field trip to visit shops of class embers.
3. Field trip to local hardware store to study tools available.
4. List and identify tools in the school shop.

5. Prepare and inventory list of tools in home shop.
6. Assume an amount of money avaialble for purchase of tools for the home shop, as $100. Prepare a purchase list with complete specifications and prices from tool catalogs or local sources.

Possible references

1. Foss, E. W., Construction and Maintenance for Farm and Home, p. 344-363
2. Phipps, Scranton, McColly and Cook, Farm Mechanics Text and Handbook, p. 13-64
3. Sampson, Mowery and Kugler, Farm Shop Skills in Mechanized Agriculture, p. 1-19
4. Wakeman and McCoy, The Farm Shop, p. 25-41
5. Jones, M. M., Shopwork on the Farm, p. 1-19
6. Roehl and Longhouse, Farmers' Shop Book, p. 161-204

Agricultural Carpentry -- Hand Tools

Possible topics for discu sion

1. What hand tools are needed for ordinary agricultural carpentry jobs?
2. What are the common woodworking operations involved in building or repairing small carpentry projects?
3. What species and grades of lumber are available in this locality?
4. What are the special features and uses for each?
5. What are the nominal and actual widths, lengths, and thicknesses of dressed lumber?
6. What types of plywood, hardboard, and other building materials are available?
7. How do you figure a cutting list and bill of materials for carpentry project?
8. What types of sketches and drawings may be used in planning a building project?
9. How do you read and interpret a blueprint?

Possible teacher activities

1. Teach how to give a demonstration.
2. Prepare samples of lumber and other building materials for selection and identification.
3. Prepare samples of fasteners for selection and identification.

Possible student activities

1. Prepare and give demonstrations of woodworking processes as:
   a. Measuring and marking
   b. Squaring
   c. Sawing
   d. Shaping and smoothing with plane, drawknife, spokeshave, rasp, sandpaper, etc.
   e. Joining with nails, screws, rivets, bolts, etc.
   f. Boring holes
2. Make sketches and draw plans of items to build.
3. Figure cutting list and bill of materials
4. Identify species, grades, and patterns of lumber.

5. Select and identify sizes and types of fasteners as nails, screws, bolts, etc.
6. Field trip to lumber yard to study available lumber and building materials.
7. Construct small individual carpentry projects needed in home shop, in supervised agriculture experience program.

Possible references

1. Foss, E. W., Construction and Maintenance for Farm and Home, p. 1-47
2. Phipps, Scranton, McColly and Cook, Farm Mechanics Text Handbook, p. 157-186, 193-262
3. Sampson, Mowery and Kugler, Farm Shop Skills in Mechanized Agriculture, p. 20-45
4. Wakeman and McCoy, The Farm Shop, p. 1-23, 210-267
5. VAS Unit 3006, Selecting Lumber and Building Materials
6. Jones, M.M., Shopwork on the Farm, p. 20-39, 40-136
7. Roehl and Longhouse, Farmers Shop Book, p. 205-270
8. Ross and Craig, Modern Farm Shop, Book I, p. 37-79

Tool Fitting

Possible topics for discussion

1. Why is it important to have sharp tools?
2. What kinds of equipment are needed to properly sharpen shop tools?
3. How should a power grinder be adjusted and used safely?
4. For what purposes are grinding wheels dressed, and how should this be done?
5. What is meant by the standard angle of keenness of a cutting tool?
6. What are the standard angles of keenness for woodcutting tools and metal-cutting tools?
7. What is meant by a "wire edge" and how is it removed?
8. How should tool handles be fitted and fastened securely?

Possible teacher activities

1. Demonstrate the adjustment and safe use of a power grinder.
2. Demonstrate the steps in grinding, filing, honing, etc. in sharpening wood chisel, plane bit, cold chisel, twist drill, axe, butcher knife, auger bit, and other common tools.
3. Demonstrate how to judge the sharpness of common edge tools.
4. Demonstrate how to fit a screw driver.
5. Demonstrate how to fit and sharpen a portable electric saw blade.

Possible student activities

1. Inventory tools at home that need sharpening and fitting.
2. Bring tools from home and sharpen them.*

Possible references

1. Foss, E.W., Construction & Maintenance for Farm and Home, p. 226-256

* A check system may be used as an incentive and to permit each student to work at his own speed.

2. Jones, M. M., Shopwork on the Farm, p. 200-260
3. Phipps, McColly, Scranton and Cook, Farm Mechanics Text and Handbook, p. 122-155
4. Roehl and Longhouse, Farmers Shop Book, p. 1-74
5. Sampson, Mowery and Kugler, Farm Shop Skills in Mechanized Agriculture, p. 253-295
6. Wakeman and McCoy, The Farm Shop, p. 42-82
7. VAS Unit 3005, Sharpening Hand Tools

Sample Check System for Tool Fitting and Sharpening

Tools	Check if Done
Wood chisel	_____
Plane bit	_____
Cold chisel	_____
Twist drill	_____
Auger bit	_____
Butcher knife	_____
Draw knife	_____
Axe	_____
Hatchet	_____
Tin snips	_____
Scissors	_____
Center punch	_____
Pruning shears	_____
Hand sickle	_____
Mower knife	_____
Circular saw blade	_____
Handle	_____
Other	_____

Students should be expected to experience a wide range of participation. It is better training to sharpen and recondition ten different tools than to recondition, for example, ten cold chisels.

Small Engines

Possible topics for discussion

1. What are some of the important uses of small engines in agriculture?
2. What are the common types of small engines?
3. What are the basic principles of four-cycle and two-cycle engine operation?
4. How is good compression maintained in small engines?
5. What are the functions of the carburetion system?
6. How does the small engine ignition system operate?
7. How is cooling provided in small engines?
8. How is small engine lubrication accomplished?
9. What service and maintenance do small engines require?
10. How is small engine "tune-up" performed?
11. What repair work can be done effectively by the operator?
12. What are some common small engine troubles, and how may they be diagnosed and corrected?

Possible teacher activities

1. Demonstrate procedure for determining engine make, model, and serial number.
2. Provide operators' and repair manuals for specific engines.
3. Locate the various parts of a small engine.
4. Discuss the function of each part.
5. Demonstrate various service, maintenance, and repair techniques.

Possible student activities

1. Locate and bring in small engine.
2. Clean the engine and check for running efficiency.
3. Disassemble engine, if required.
4. Clean parts and check for wear.
5. List parts needed and obtain them.
6. Replace worn parts.
7. Reassemble engine.
8. Service, start and adjust engine (See suggested procedure work sheet.)

Possible references

1. Operators' Manual and Repair Manual for specific engine.
2. Implement & Tractor, Small Engines Manual.
3. Purvis, J., All About Small Engines.
4. VAS 3014, Small Engines--Principles of Operation, Trouble Shooting and Tune Up.

Procedure Work Sheet

SERVICING SMALL ENGINES

I. Note Nameplate information

Make of engine_____

Model_____

Serial number_____

II. Determine special features of engine. (Use operator's manual, I&T Manual, or other references.)

A. Four-cycle or two-cycle_____
B. Bore and stroke _____
C. Piston displacement_____
D. Horsepower_____
E. Dry type or oil bath air cleaner_____
F. Float type or suction type carburetor_____
G. Mechanical or air vane governor_____
H. Other Features_____
_____
_____

III. Determine general condition of engine

A. Check compression
1. Crank engine and note "rebound"
2. Listen for valve leakage when engine is turned over slowly
3. Make compression test
4. Put oil in spark plug hole and retest compression

B. Check ignition spark
1. Remove plug, connect wire to plug laying on top of engine, turn engine over and note spark
2. Repeat with wide gap plug or spark tester. Spark should jump .166 gap.

IV. Disassemble engine (Use operator's manual, I&T Manual, etc., as guide)

A. Steps in disassembly and service
1. Drain crankcase
2. Remove air cleaner
   a. General condition of air cleaner_____
   b. Clean parts thoroughly
3. Remove fuel tank
   a. Drain tank
   b. Look in bottom of tank. What did you find?_____
   c. Clean lines, screens, etc.
4. Remove and disassemble carburetor
   a. How many adjustments does it have?_____
   b. What do they control? _____
   c. Check setting of float, if present_____
   d. Clean carburetor parts with gum solvent
   e. Check for worn parts
5. Service ignition system
   a. Remove and examine spark plug
      (1) Is it the type recommended?_____
      (2) Check condition of spark plug
      (3) Clean and gap, or replace and gap plug
   b. When does the spark occur?_____
      (remove head if necessary)
   c. Check condition of breaker points
      (1) Clean or replace points
      (2) Set gap
      (3) Check condenser
      (4) Check timing of spark
   d. Check other adjustments, such as armature air gap
6. Remove and service valves
   a. What is the condition of the valves?
      (1) Intake valve_____
      (2) Exhaust valve_____
   b. Service valves and valves and valve seats as required
   c. Reassemble valves and adjust to proper clearance
7. Remove pistons and rings
   a. Check cylinder for wear_____
   b. Check piston skirt clearance and compare with allowable___
      _____
   c. Check ring clearance and compare with allowable_____
      _____
   d. Check crankshaft for wear_____

8. Replace piston and rings
9. Check crankshaft bearings and connecting rod bearing
10. Perform other service needed

B. List of parts needed

V. Reassemble engine (Use operator's manual, I&T Manual, etc.)

A. Replace gaskets, oil seals, etc., as needed

B. Replace engine head, tightening studs as recommended in references

C. Replace miscellaneous parts, as crankcase cover, valve cover, carburetor, fuel tank, air cleaner, etc.

D. Replace crankcase oil and fuel

VI. Start engine and adjust to optimum operating condition

METAL WORK

Possible topics for discussion

1. What kinds, shapes, and sizes of metal are available for agricultural construction and repair?
2. How can you estimate the quantity of metal required and the price?
3. What operations are commonly performed on cold metal?
4. For what operations is metal usually heated?
5. In what ways can metal be cut?
6. How can it be shaped and smoothed?
7. How do we drill, tap, and thread metal?
8. How can power metal working tools be used properly and safely?
9. How can sheet metal be cut, formed, punched, and joined?

Possible teacher activities

1. Demonstrate safe use of drill press, portable drills, power hack saw, grinders, and other metal cutting power tools.
2. Demonstrate how to identify metals.
3. Demonstrate hand processes for cutting, shaping, bending, punching, tapping, and threading.
4. Demonstrate how to cut, form, and punch sheet metal.
5. Demonstrate how to join sheet metal by using rivets, sheet metal screws, solder, and brazing.

Possible student activities

1. Practice various hand metal working operations in construction or repair.
2. Use power metal working tools in construction and repair.

Possible references

1. Foss, E. W., Construction and Maintenance for Farm and Home, p. 147-212
2. Jones, M. M., Shopwork on the Farm, p. 327-408
3. Phipps, etal, Farm Mechanics Text and Handbook, p. 313-355
4. Roehl and Longhouse, Farmers Shop Book, p. 90-116, 149-160
5. Ross and Craig, Modern Farm Shop, Book I, p. 87-105
6. Sampson, etal, Farm Shop Skills in Mechanized Agriculture, p. 145-158, 169-204
7. Wakeman and McCoy, The Farm Shop, p. 83-113, 193-209
8. WAS 3002, Farm Metalwork

Power Tool Construction--Major Carpentry Project

Possible topics for discussion

1. What power tools should a well-equipped agricultural shop have?
2. What special safety precautions should be observed in using power saws and other power woodworking tools?
3. What are the common parts of a building?
4. How is the square used in agricultural construction?
5. What items of hardware are used in a building, and how are they sized and priced?

Possible teacher activities

1. Demonstrate safe and proper use of power tools.
2. Demonstrate how to square a building, plumb a stud, etc.
3. Demonstrate how to use the square in marking braces, rafters, etc.
4. Demonstrate the fitting and joining the parts of a building.

Possible student activities

1. Take a field trip to study the products available from a local building materials dealer.
2. Construct a building project, making maximum use of power tools.

Possible references

1. Foss, E.W., Construction and Maintenance for Farm and Home, p. 48-98
2. Jones, M. M. Shopwork on the Farm, p. 40-182.
3. Phipps, etal, Farm Mechanics Text and Handbook, p. 104-121, 175-186, 197-203
4. Roehl and Longhouse, Farmers Shop Book, p. 205-270
5. Ross and Craig, Modern Farm Shop, Book I, p. 37-79
6. Sampson, etal, Farm Shop Skills in Mechanized Agriculture, p. 46-81
7. Wakeman and McCoy, The Farm Shop, p. 210-236, 269-340

Painting and Finishing

Possible topics for discussion

1. What are the chief purposes of painting agricultural buildings?
2. What factors are considered in selecting the paint to use?
3. How should surfaces be prepared for painting? For repainting?
4. How do you estimate the quantity of paint required?
5. How should paint be applied by the brush method?
6. How should paint be applied by the spray method?
7. How do you clean up painting equipment when the job is finished?
8. How is glass measured and cut?
9. How do you fasten the glass in the sash and putty it?

Possible teacher activities

1. Demonstrate how to prepare a surface for painting.
2. Demonstrate how to mix paint.
3. Demonstrate how to apply paint with a brush.
4. Demonstrate how to fit a paint sprayer and apply paint with it.
5. Demonstrate how to clean a brush and a paint sprayer.
6. Demonstrate how to measure and cut glass.
7. Demonstrate how to fasten and putty glass in a window sash.

Possible student activities

1. Take a field trip to a paint store to study paint formulas and select paints and equipment.
2. Apply paint with brush and sprayer to an agricultural building or carpentry project.
3. Clean brushes and sprayer.
4. Measure and cut glass.
5. Fasten the glass in a sash and putty it.

Possible references

1. Foss, E.W., Construction and Maintenance for Farm and Home, p. 129-146
2. Jones, M.M., Shopwork on the Farm, p. 183-199
3. Phipps, etal, Farm Mechanics Text and Handbook, p. 204-239
4. Sampson, etal, Farm Shop Skills in Mechanized Agriculture, p. 82-108
5. Wakeman and McCoy, The Farm Shop, p. 341-356
6. VAS 3015, Spray Mainting

Agricultural Plumbing

Possible topics for discussion

1. What are the water requirements of your home?
2. What are the essential parts of a good water supply system?
3. What kinds and sizes of pipe and tubing may be used for water supply and waste disposal?
4. What various kinds of fittings may be used?
5. What tools and equipment are required for agricultural plumbing?
6. How are the various types of pipe and tubing measured, cut and joined?
7. How can valves, faucets, and other common plumbing fixtures be maintained?
8. How can the waste disposal system be planned, installed, and maintained?

Possible teacher activities

1. Arrange field trip to inspect available pumps, pressure systems pipe, fittings, etc. at materials dealer's place of buisness.
2. Arrange field trip to inspect complete water supply and disposal system on a farm or other agricultural production plant such as a greenhouse.
3. Demonstrate how to use various pipe-cutting and fitting tools.
4. Demonstrate techniques on servicing and maintaining pumps, pressure systems, and plumbing fixtures.

Possible student activities

1. Survey needs and plan improvements in water supply and waste disposal system at home.
2. Learn to identify and select types and sizes of pipe and tubing.
3. Learn to identify and select types and sizes of fittings.
4. Learn and practice abilities to:
   a. Measure, cut, ream, thread, and join steel pipe.
   b. Measure, cut, ream, and join copper tubing, using:
      (1) Sweat fittings
      (2) Flare fittings
   c. Measure, cut and join plastic pipe.
   d. Measure, cut, and join cast iron soil pipe with oakum and lead with joints in:
      (1) Vertical position
      (2) Horizontal position
5. Extend water supply or disposal system at home if needed.
6. Service and maintain fixtures at home.

Possible references

1. Jones, M.M., Shopwork on the Farm, p. 460-477.
2. Phipps, etal, Farm Mechanics Text and Handbook, p. 635-678.
3. Sampson, etal, Farm Shop Skills in Mechanized Agriculture, p. 158-168
4. Wakeman and McCoy, The Farm Shop, p. 357-375

Arc Welding

Possible topics for discussion

1. How can arc welding be used in agricultural construction and repair?
2. What equipment and supplies are needed for arc welding?
3. How can arc welding equipment be safely installed and used?
4. What are the steps in learning to weld?
5. What different types of welds may be required?
6. What special techniques are required in vertical, horizonal, and overhead welding?
7. How can distortion be controlled in welding?
8. How can you cut with an arc welder?
9. How is the carbon-arc torch used?
10. How is the arc welder used for hard surfacing, welding cast irons, and other special purposes?

Possible teacher activities

1. Demonstrate safe operation of the welder, including use of fire and burn protection equipment.
2. Demonstrate how to strike and regulate the arc.
3. Demonstrate approved techniques for downhand, vertical, horizontal, and overhead welding.
4. Demonstrate how to test a weld safely and to judge its quality.
5. Demonstrate how to select, identify, and use special electrodes.
6. Demonstrate how to apply hard surfacing materials and perform other specialized operations.

Possible student activities

1. Make practice welds of various types in all positions.
2. Test these welds, striving for improvement in quality and appearance.
3. Construct items needed.
4. Repair items needed.

Possible references

1. Foss, E.W., Construction and Maintenance for Farm and Home, p. 291-318
2. Jones, M.M., Shopwork on the Farm, p. 478-523
3. Phipps, etal, Farm Mechanics Text and Handbook, p. 241-278
4. Roehl and Longhouse, Farmers Shop Book, p. 384-417
5. Ross and Craig, Modern Farm Shop, Book I, p. 106-123
6. Sampson, etal, Farm Shop Skills in Mechanized Agriculture, p. 223-252
7. Wakeman and mcCoy, The Farm Shop, p. 129-165
8. VAS 3004, Arc Welding
9. Kugler,H.L., Arc Welding Lessons for School and Farm Shop

Oxy-Acetylene Welding and Cutting

Possible topics for discussion

1. What eqipment is needed for oxy-acetylene welding and cutting?
2. How should the equipment be set up and tested for leaks?
3. What safety precautions should be taken with gas welding equipment?
4. How is the blowpipe lighted and the flame adjusted?
5. What is the proper procedure used in cutting with the oxy-acetylene flame?
6. How is bronze welding performed?
7. What are the steps in fusion welding?
8. How is hard surfacing applied with the oxy-acetylene flame?
9. How can the oxy-acetylene flame be used for heating and bending?
10. How can heat treating be done with the oxy-acetylene flame?

Possible teacher activities

1. Demonstrate safe handling of gases and gas-welding equipment.
2. Demonstrate how to set up equipment, test for leaks, light, and adjust flame.
3. Demonstrate proper procedures in cutting, bronze welding, fusion welding, etc.
4. Demonstrate how to test welds safely and judge their quality.
5. Demonstrate special techniques used in hard surfacing, heat treating, etc.

Possible student activities

1. Practice for safety and proficiency in handling gas welding and cutting equipment.
2. Make practice cuts and welds of various types in all positions and with a variety of metals.
3. Construct items needed on the home farm and for supervised farming program.
4. Repair items needed on the home farm and for supervised farming program.

Possible references

1. Foss, E.W., Construction and Maintenance for Farm and Home, p. 257-290
2. Jones,W.W., Shopwork on the Farm, p. 524-553
3. Phipps, etal, Farm Mechanics Text and Handbook, p. 279-310
4. Roehl and Longhouse, Farmer's Shop Book, p. 384-417
5. Ross and Craig, Modern Farm Shop, Book I, p. 124-141
6. Sampson, etal, Farm Shop Skills in Mechanized Agriculture, p. 205-223
7. Wakeman and McCoy, The Farm Shop, p. 166-192
8. VAS 3001, Using the Oxy-Acetylene Flame in Farm Construction and Repair
9. Linde Company, Oxy-Acetylene Handbook

Agricultural Machinery

Possible topics for discussion

1. What is the total investment in agricultural machinery at your home or in a local agricultural business.
2. What are the factors considered in selecting machinery and fitting it to a specific agricultural operation?
3. How can a good program of agricultural machinery maintenance, adjustment and repair add to your profits?
4. What are the major classes of agricultural machines used in this community?
5. What facilities are needed for storage, maintenance, and repair of agricultural machinery?
6. What general and specific safety measures should be used in the operation of agricultural machinery?

Possible teacher activities

1. Arrange field trips to observe operation and adjustment of agricultural machinery.
2. Secure machines from local dealers for study and adjustment.
3. Provide operators' manuals needed for specific machines.
4. Demonstrate techniques for adjustment, service, and maintenance.
5. Demonstrate repair techniques.

Possible student activities

1. Bring in a machine that student is capable of operating himself.
2. Identify the machine as to make and model, and obtain an operator's manual and parts list for that machine.
3. Using the manual as a guide, go over the machine systematically as follows:
   a. Clean machine thoroughly-brush, scrape, hose, solvent, steam.
   b. Disassemble as necessary.
   c. Check for parts that need repair.

d. Check for parts that should be replaced.
   (1) Consult with father or owner of machine
   (2) Consult implement dealer
   (3) Order repairs by proper name and part number
e. Repair, recondition, and sharpen cutting parts wherever practical.
f. Put on new parts as determined in e above.
g. Reassemble machine carefully.
h. Repaint machine, if needed
   (1) Use rust inhibiting paint on bare metal
   (2) Apply finish coat of standard implement colors
   (3) Apply decals if available.
i. Lubricate and service machine carefully.
j. Adjust machine in the shop.
k. Adjust and operate machine in the field.

4. Demonstrate special abilities learned to members of the class.
5. Record time spent and cost of repairs.

Possible references

1. Jones,M.M., Shopwork on the Farm, p. 554-577
2. Phipps, etal, Farm Mechanics Text and Handbook, p. 479-557
3. Roehl and Longhouse, Farmers Shop Book, p. 418-442
4. Sampson, etal, Farm Shop Skills in Mechanized Agriculture, p. 330-355
5. Hunt, D., Farm Power and Machinery Management
6. Stone and Gulvin, Machines for Power Farming
7. Turner and Johnson, Machines for the Farm, Ranch, and Plantation

Sample Check List for Field Machinery

1. Kind of Machine--Corn Picker	Check when Job is done
Lubricate a corn picker	_____
Service a plugged grease fitting	_____
Pull a gear or pulley	_____
Adjust tension on a belt	_____
Lubricate a steel chain	_____
Lubricate a roller chain	_____
Service a gear box (change lubricant)	_____
Time gathering chains	_____
Adjust tension on gathering chains	_____
Time snapping rolls	_____
Adjust snapping rolls from wet to dry condition	_____
Adjust snapping bars	_____
Adjust slip clutch and check	_____
Adjust air blast	_____
Change pressure on air blast	_____
Other activity	_____
" "	_____

Tractor Maintenance

Possible topics for discussion

1. What are some common types and sizes of farm tractors used in the community and what is the range of prices for these types?
2. What factors should be considered in selecting a tractor for a given agricultural situation?
3. What are the advantages of gasoline, diesel, and LP-gas tractors?
4. What are the various system of a tractor that require maintenance?
5. What repair jobs can be done in the farm shop and which ones should be done by a trained repairman?
6. What record should be kept on a tractor?
7. What safety practices should be followed in tractor operation?

Possible teacher activities

1. Arrange field trip to observe safety practices in tractor operation.
2. Provide operators' manuals needed for specific tractors.
3. Demonstrate procedures used in tractor service, maintenance, and tune-up.
4. Arrange field trip to dealer's repair shop to observe specialized repair equipment and procedures.

Possible student activities

1. Bring in tractor of type operated by student.
2. Using operators' manual as a guide, work over the tractor systematically as follows:
   a. Lubricate tractor--general.
   b. Lubricate and adjust front wheels.
   c. Change oil in crankcase and service oil filter.
   d. Check and, if necessary, add to or change lubricant in steering gear, transmission, differential, final drive, etc.
   e. Service crankcase breather.
   f. Service air Cleaner.
   g. Drain, flush, and refill cooling system.
   h. Clean fuel filter and sediment bowl.
   i. Service battery, lights, generator, and starter.
   j. Service tires.
   k. Adjust clutch and brakes.
   l. Service hydraulic system.
   m. Diagnose engine condition and tune engine:
      (1) Make compression test and determine cause of compression losses, if present.
      (2) Make vacuum test.
      (3) Inspect, clean, or replace, and gap plugs.
      (4) Inspect, clean, or replace, and gap distributor points.
      (5) Time engine
      (6) Check and adjust tappet clearances.
      (7) Check float level and adjust carburetor.
   n. Make miscellaneous minor repairs and adjustments.
3. Demonstrate abilities learned to members of the class.
4. Record time spent and cost of repairs.

Possible references

1. Phipps, etal, Farm Mechanics Text and Handbook, p. 393-443, 451-458
2. VAS 3008, Farm Tractor Tune-Up
3. Brown and Morrison, Farm Tractor Maintenance
4. Johnson and Hollenber, Servicing Maintaining Farm Tractors
5. Promersberger and Bishop, Modern Farm Power
6. Stone and Gulvin, Machine for Power Farming, p. 1-148
7. Turner and Johnson, Machines for the Farm, Ranch, and Plantation, p. 521-628
8. Implement and Tractor, I.&T. Tractor Manual

Sample Check List for Shop Work in Tractor Servicing	Check when Job is Done
1. Lubricate front wheel bearings	
2. Pack front wheel bearings	
3. Change oil in crank case	
4. Change lubricant in a gear box	
5. Clean and service crank case breather	
6. Clean and service oil filter	
7. Clean and service the air cleaner	
8. Drain and flush cooling system	
9. Clean and replace sediment bowl	
10. Service the battery	
11. Check and service hydraulic system	
12. Check and service tires	
13. Adjust clutch	
14. Adjust brakes	
15. Make compression test (all cylinders)	
16. Make vacuum test	
17. Remove, inspect, clean or replace, space gap, plugs	
18. Service (regap or replace points)	
19. Time engine	
20. Check and adjust tappet clearance	
21. Adjust carburetor	
22. Adjust or replace fan belt	
23. Others	
24.	
25.	

Concrete and Concrete Masonry

Possible topics for discussion

1. What are the advantages of concrete and concrete masonry as agricultural building materials?
2. From what ingredients is concrete made?
3. How are these ingredients selected and proportioned?
4. When does it pay to mix concrete and when to use ready-mix?
5. How should concrete forms be constructed, set, and braced?
6. How should concrete be placed, finished, and cured?
7. Why, when, and how do we reinforce concrete?
8. How can you estimate quantities of materials and costs for a concrete or concrete masonry job?

Possible teacher activities

1. Conduct field trip to ready-mix plant to observe methods of proportioning and mixing concrete.
2. Conduct field trip to concrete block plant to observe construction and curing of masonry units
3. Demonstrate test for quality of aggregates, slump test, etc. of concrete.
4. Demonstrate how to place, screen, finish, and cure concrete.
5. Demonstrate how to proportion and mix mortar.
6. Demonstrate how to handle mortar, lay concrete blocks, cut blocks, strike joints, etc.
7. Schedule and obtain VAS sectional concrete kit, unless one is owned by school.

Possible student activities

1. Perform laboratory exercise with concrete kit to determine the effect of various factors on the strength of concrete as indicated by breaking strength of test beams.
2. Estimate materials needed for a concrete job and determine costs of ready-mixed concrete vs home-mixed concrete for it.
3. Carry out a concrete job, either as an individual or group project.
4. Practice to develop skills in concrete masonry.
5. Carry out a concrete masonry job either as an individual or group project.

Possible references

1. Foss,E.W., Construction and Maintenance for Farm and Home,p. 99-128
2. Jones, M.M., Shopwork on the Farm, p. 307-326
3. Phipps, etal, Farm Mechanics Text and Handbook, p. 591-633
4. Ross and Craig, Modern Farm Shop, Book I, p. 142-152
5. Sampson, etal, Farm Shop Skills in Mechanized Agriculture, p. 109-144
6. Wakeman and McCoy, The Farm Shop, p. 376-394
7. VAS 3007, Making and using concrete on the Farm

Agricultural Electrification

Possible topics for discussion

1. What uses are made of electricity in agricultural oriented businesses in the community?
2. What is electricity and how is it measured?
3. What are the parts of a circuit?
4. How are circuits connected in series and in parallel?
5. How and why can we get both 120 and 240 volts from a three-wire service?
6. What are the reasons for and approved methods of grounding the electrical system?
7. How can we select the various types and sizes of wires and cables?
8. How can wiring be installed safely according to the National Electrical Code and other standards?

Possible teacher activities

1. Conduct field trips to observe adequate agricultural wiring systems, power supplier-distribution systems, etc.

2. Demonstrate principles of electricity, transformers, circuit protection, etc.
3. Demonstrate skills in handling wire and other wiring materials.
4. Demonstrate how to test a wiring circuit for proper operation, polarity, etc.

Possible student activities

1. Select and identify wiring materials.
2. Diagram simple wiring circuits.
3. Install, connect, and test, as exercises:
   a. Outside wiring (weatherproof).
   b. Service entrances using conduit, cable.
   c. Duplex receptacles--plain and grounding type.
   d. Lights controlled by:
      (1) Pull chain
      (2) Single-pole switch
      (3) Three-way switches
      (4) Four-way switches
   e. Remote control yardlight system.
4. Extend wiring system at home.
5. Maintain or repair wiring system at home.
6. Study the National Electrical Code and become familiar with applicable requirements.

Possible references

1. VAS 3003a, Electrical Wiring--Principles and Planning
2. VAS 3016, Electrical Wiring--Procedures and Exercises
3. National Electrical Code (Latest edition)
4. Jones, M.M., Shopwork on the Farm, p. 578-607
5. Phipps, etal, Farm Mechanics Text and Handbook, p. 707-746
6. Roehl and Longhouse, Farmers Shop Book, p. 357-383
7. Sampson, etal, Farmer Shop Skills in Mechanized Agriculture, p. 296-316
8. Wakeman and McCoy, The Farm Shop, p. 409-431

Electric Motors

Possible topics for discussion

1. What are the advantages of electric motors for agricultural power?
2. What factors should be considered in selecting motors?
3. How can types and sizes of motors be identified?
4. How should motors be installed properly?
5. What maintenance and care of motors require?
6. How are motors controlled and protected?
7. How can motor troubles be diagnosed and corrected?
8. On what principles do electric motors operate?

Possible teacher activities

1. Conduct field trips to observe safe and adequate use of electric power in agriculture.
2. Schedule and secure VAS Electric motors kit from local power supplier representative.

3. Demonstrate how to read and interpret motor nameplate information.
4. Demonstrate principles of magnetism and induction.
5. Demonstrate how to use d.c. and a.c. testing equipment.
6. Demonstrate how to connect and reverse motors.
7. Demonstrate how to disassemble, clean test, and reassemble motor.

Possible student activities

1. Connect, operate, and reverse d.c. laboratory demonstration motor, using:
   a. Permanent magnet field.
   b. Electromagnet field.
      (1) Parallel connected
      (2) Series connected
2. Perform no-load and locked-rotor tests on three types of motors, measuring torque, current, and line-voltage effects.
3. Analyze data obtained from these tests and apply them to motor selection.
4. Test and identify motor leads, connect, reverse, and connect to more than one voltage if applicable.
5. Bring old motors from home to test, clean, service, and make simple repairs.

Possible references

1. VAS, Electric Motors for Farm Use.
2. Phipps, etal, Farm Mechanics Test and Handbook, p. 747-758
3. Sampson, etal, Farm Shop Skills for Mechanized Agriculture, p. 316-329
4. VAS Slidefilm 412, Magnetism and the DC Motor.
5. VAS Slidefilm 413, Induction and the AC Motor.
6. VAS Slidefilm 414, Testing and Identifying Leads, Connecting and reversing.
7. VAS Slidefilm 415, Trouble Shooting.

Agricultural Surveying--Soil and Water Equipment

Possible topics for discussion

1. What equipment is needed for simple agricultural surveying?
2. How are distances measured with a steel tape, range poles, and marking pins?
3. How can we measure and calculate the area of various-shaped fields?
4. How is the hand level used in determining land slopes and in laying out contour lines?
5. How is the tripod level set up, adjusted, and tested for accuracy?
6. How is differential leveling and profile leveling accomplished?
7. How should the field notebook be kept?
8. How can the level be used for staking out fence lines, building foundations, farm ponds, drainage ditches, tile lines, waterways, terrace systems, etc.?

Possible teacher activities

1. Demonstrate proper use of the tape in measuring distances.
2. Demonstrate how to calculate field areas.
3. Demonstrate the use of the hand level.
4. Demonstrate how to set up and test the tripod level.
5. Demonstrate how to perform various leveling and lining-up operations.

Possible student activities

1. Take a field trip to observe good soil and water management structures and practices.
2. Measure distances and calculate field areas
3. Determine land slope and lay out contour lines.
4. Set up, adjust, and test the tripod level with the two-peg test.
5. Operate the target rod efficiently.
6. Keep field notes and make calculations accurately.
7. Make differential and profile leveling surveys.
8. Stake out fence lines, building foundations, ponds, waterways, open ditches, tile drains, and terrace systems.

Possible references

1. Phipps, etal, Farm Mechanics Text Handbook, p. 761-802
2. Schwab, etal, Elementary Soil and Water Engineering.
3. VAS 3010, Farm Surveying

PLANNING THE PROGRAM OF INSTRUCTION IN AGRICULTURAL MECHANICS FOR YOUR SCHOOL

The ideas and information contained in this publication are merely suggestive in nature and are not intended to be followed without modification. The only good plan for your school is the plan that you make to fit your own specific situation. The principles given here have been tested and approved by many good teachers. The specific application of these principles, however, depends on the needs of your community in general and on the needs and interests of your students in particular.

The best program for your situation also depends on your interest, initiative, and ability as a teacher and on the type of agricultural mechanics facilities and equipment with which you have to work. Most communities have provided adequate facilities and are willing to provide the equipment. The local community has the students. THEY AWAIT THE CHALLENGE OF A WELL PLANNED AND STIMULATING MECHANICAL INSTRUCTION PROGRAM. The implementation of some of the ideas included in this bulletin could be helpful to the total instructional program in each department. This implementation should become a challenge to each local teacher of vocational agriculture.